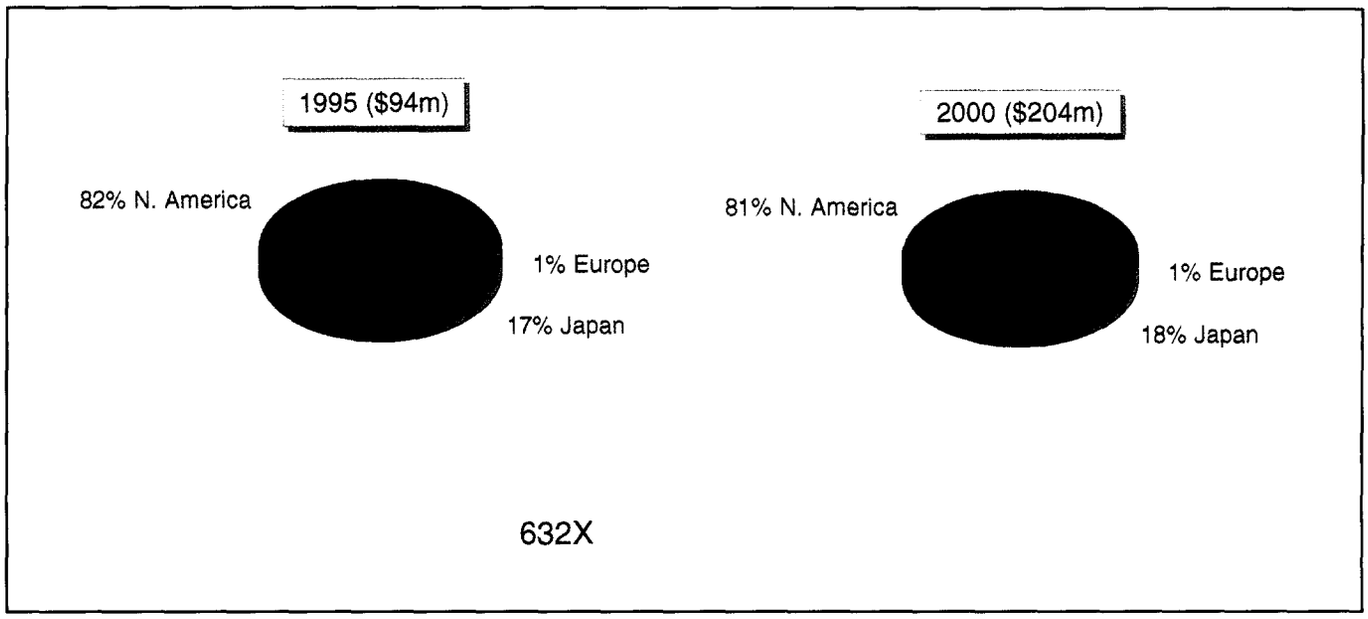
Digital GaAs ICs — from Supercomputers to Comms

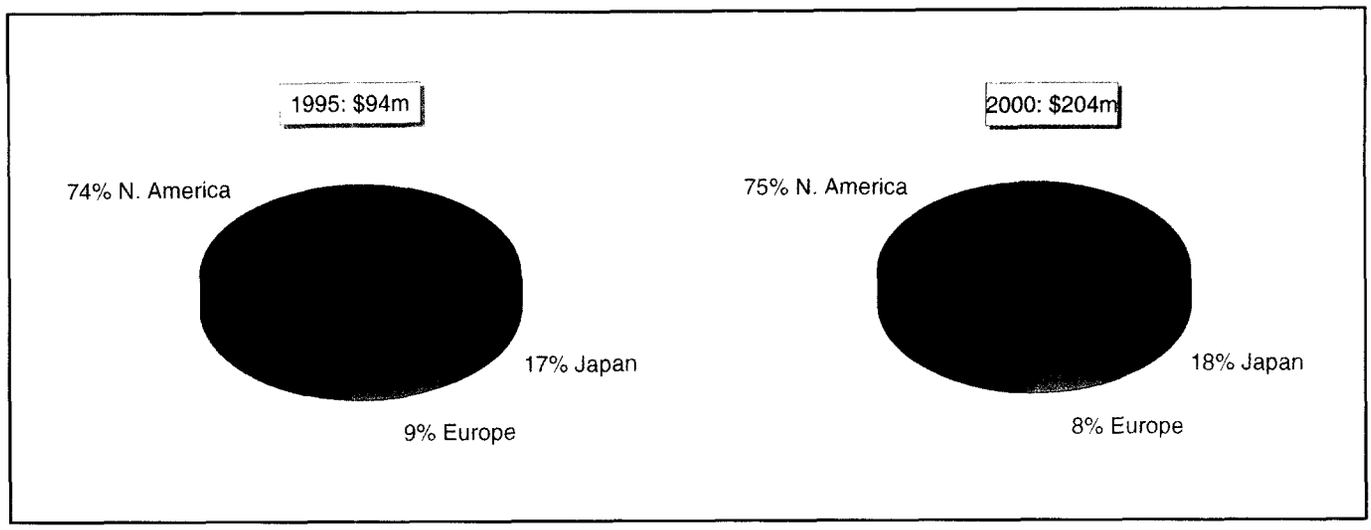
by Roy Szweda

It is timely to overview the prospective status of digital GaAs ICs now that judgement has formally been passed on the disposal of the torch-carrier Cray Computer Corp. Symbolic to the end, the Colorado fab is set for RF microwave devices for M/A-COM rather than digital parts for Cray-4s. Digital GaAs has seen a shift to high speed tele- and data-comms and ATE where the margins over silicon are better marked.



World GaAs Digital IC Market by Geographical Region.

This series has looked at merchant-epiwafers and substrates reflecting the coverage of the second edition of the report "GaAs Electronic Materials & Devices – A Strategic Study of Markets, Technologies & Companies Worldwide" soon to be published by Elsevier Advanced Technology in collaboration with *III-Vs Review*. The report's author, Simon Lande of Magus Research, says that Cray Computer's final collapse "marked the end of any real hope for GaAs delivering a major impact in the computing environment. However, on a strictly performance basis, the superior physical properties of GaAs are clear. For equivalent geometries, GaAs has the potential to perform about twice the speed of Si and consume roughly half the power. This allows more tolerant design rules for high performance-critical parts of systems especially in telecoms and datacoms with total consumption expected to reach $204 m by 2000. The "Information Superhighway" will have some impact on digital GaAs in the short-term but



World Digital GaAs IC Production by Geographical Region.

improve later on when very high speed (10 Gbit/s) systems are required – at this point, HBT technology's lower power capability may be significant."

A key application sector for digital GaAs ICs is high speed serial data transmission equipment for mainframe interconnection. Seagate and Interphase are evaluating GaAs for connecting computers and peripherals – the Vitesse "EZ-link" ICs are aimed at cost-sensitive insertions for partitioning logic into 2 x GaAs and 1xCMOS chip sets. This is but one example of how one of the pioneers of foundry digital GaAs has shifted its focus computing to Comms (see *III-Vs Review* (Vol. 7, no. 4 pp. 26-32) "Talk About Leading Edge" and "GaAs Fabs at Home in Datacoms", (Vol. 7 no. 5, pp. 42-49)).

Automated test equipment (ATE) is emerging as a small but significant market with digital GaAs being used mainly as an ECL-replacement to reduce power, lower costs and improve performance. DDS (direct digital synthesis) is another rapidly growing method of frequency synthesis. As a lower power technology, digital GaAs could find its way into battery-powered portable instrumentation and comms.

In terms of production, digital GaAs ICs are the preserve of N. American companies with only Fujitsu in contention elsewhere. In addition, N. America comprises almost three quarters of the market – see Figure 1. Users include computer and most of the large telecom companies. Demand worldwide will increase and steadily erode American dominance. Captive production of digital GaAs ICs is the minority share; currently at 12% with little increase expected by 2000. Vitesse Semiconductor is the market leader emphasising DCFL implanted MESFET technologies rather than epitaxial substrate materials. TriQuint is second, followed by Fujitsu. In terms of device types digital GaAs remains niche-driven. It has not gained significantly in the staple devices of mainstream Si, i.e. memories and micro's; ASICS – gate arrays and cells – are preferred with ASSPs gaining ground. Long term prospects include GaAs RISC micro's as well as DSP functions – again perhaps as ASIC cores and (later) ASSPs – for portable equipment.

In terms of device types MESFET n-channel based ICs are dominant – over 90% in 1995 – with other types, particularly heterostructure devices such as HEMTs, HBTs, etc. not yet in volume production for LSI ICs. These will slowly gain ground but until today's present players have exhausted the potential of implant-based MESFET digital GaAs, epi investment will be small. Motorola, Rockwell and TI have HBT-based demonstrator IC products underway and Fujitsu has been developing HEMT digital ICs for a while. The advent of mixed-signal front-ends etc. will drive the HBT device types but there is likely to be a considerable learning curve for designers and producers alike before this intriguing sector reaches significant market-share.

We will be taking a look at MMICs in the next issue where the story for GaAs ICs is much happier. As is reflected in the heavily biased ratio of MMIC to digital papers at the imminent IEEE GaAs IC Symposium (see Diary, this issue), the mm- and micro-wave IC business is very definitely the driver for GaAs ICs and will remain so beyond 2000.

The report (ISBN 1 85617 214 7) is available shortly priced £1250 ($1750) to order your copy or free copy of the Report Prospectus, please contact:

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